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(54) **OPTICAL CONNECTOR AND OPTICAL MODULE HAVING THE SAME**

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G02B 6/36 (2006.01)
G02B 6/42 (2006.01)

(52) **U.S. Cl.**
CPC ***G02B 6/38*** (2013.01); ***G02B 6/3608*** (2013.01); ***G02B 6/4214*** (2013.01)

(58) **Field of Classification Search**
CPC G02B 6/4214
See application file for complete search history.

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(57) **ABSTRACT**

Disclosed herein is an optical module including: an optical element mounted on a substrate; and an optical connector mounted corresponding to the optical element so as to change a path of an optical signal of the optical element and transfer the optical signal having the changed path. The optical module may provide various communication performances using an optical connector in which first and second connector parts are optically coupled stably to each other. Particularly, the optical module does not have a silicon optical bench (SiOB) as a medium, thereby making it possible to reduce a thickness of a product.

10 Claims, 3 Drawing Sheets

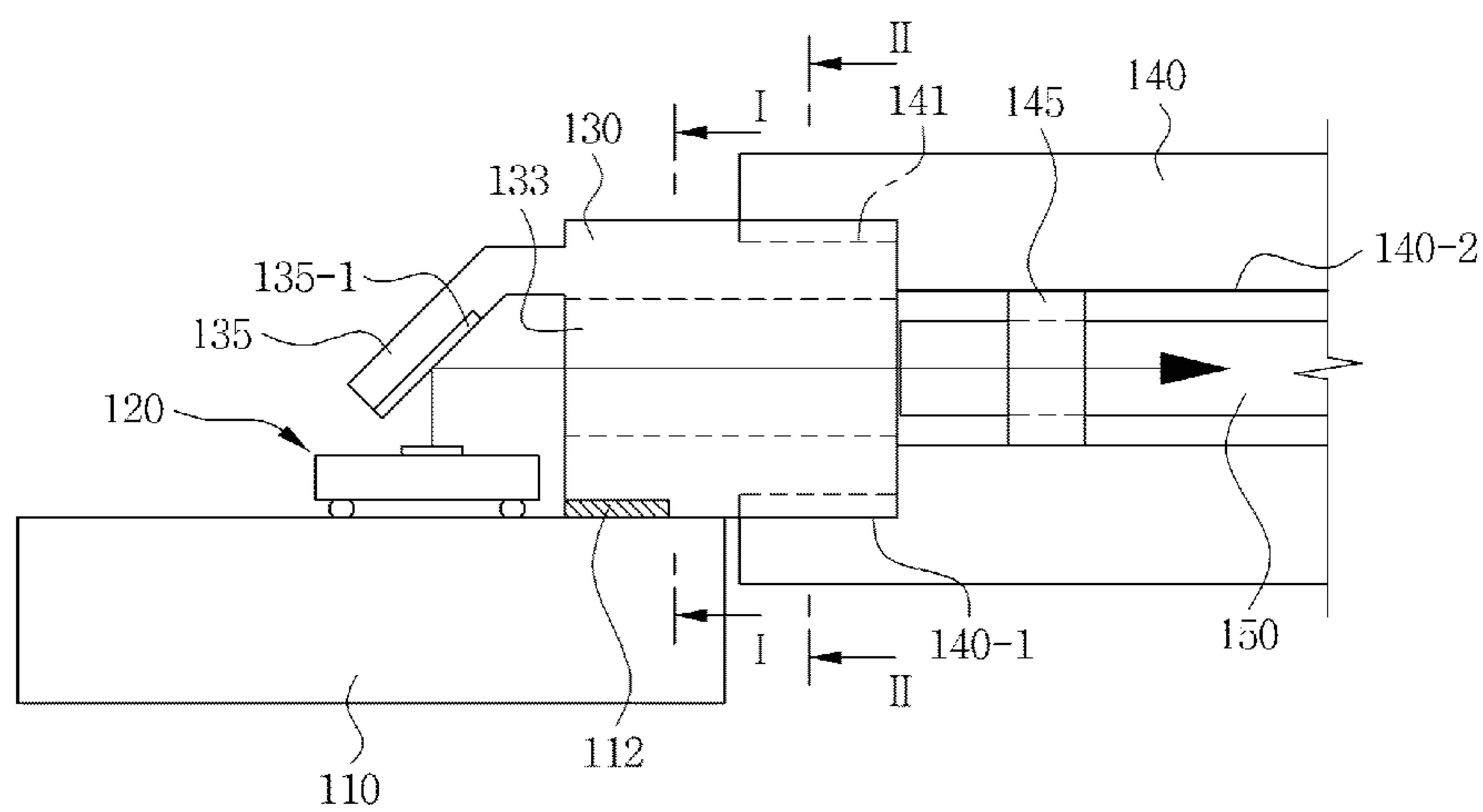


FIG.1

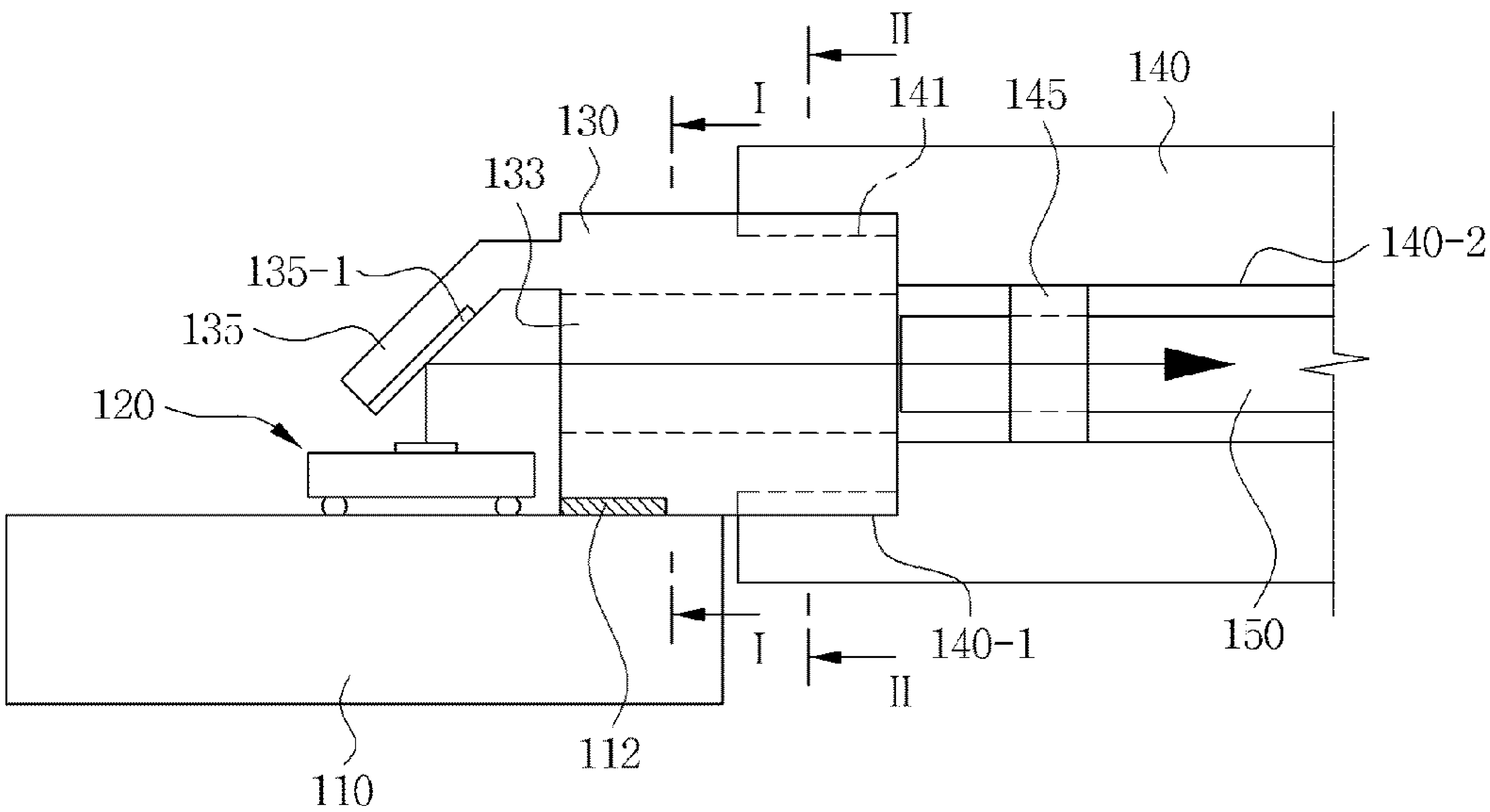

II
I
130
141
145
140
133
135-1
140-2
135
120
110
112
I
II
140-1
150

FIG.2A

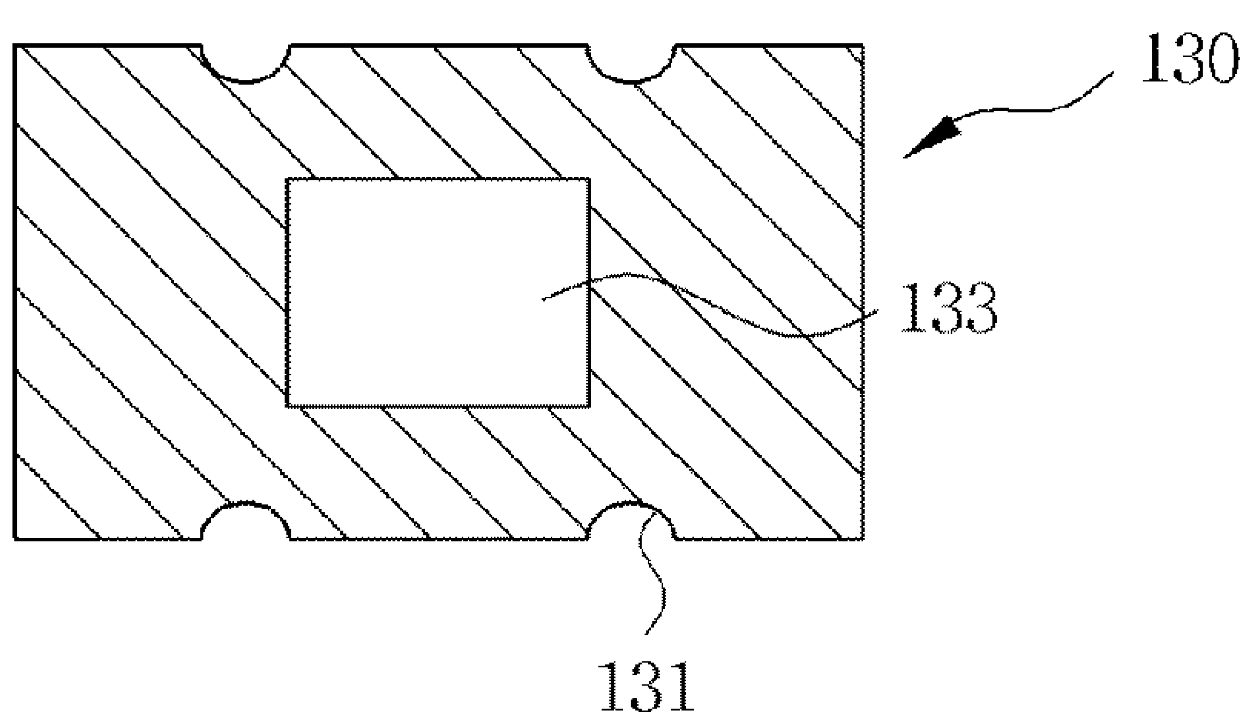

130
133
131

FIG.2B

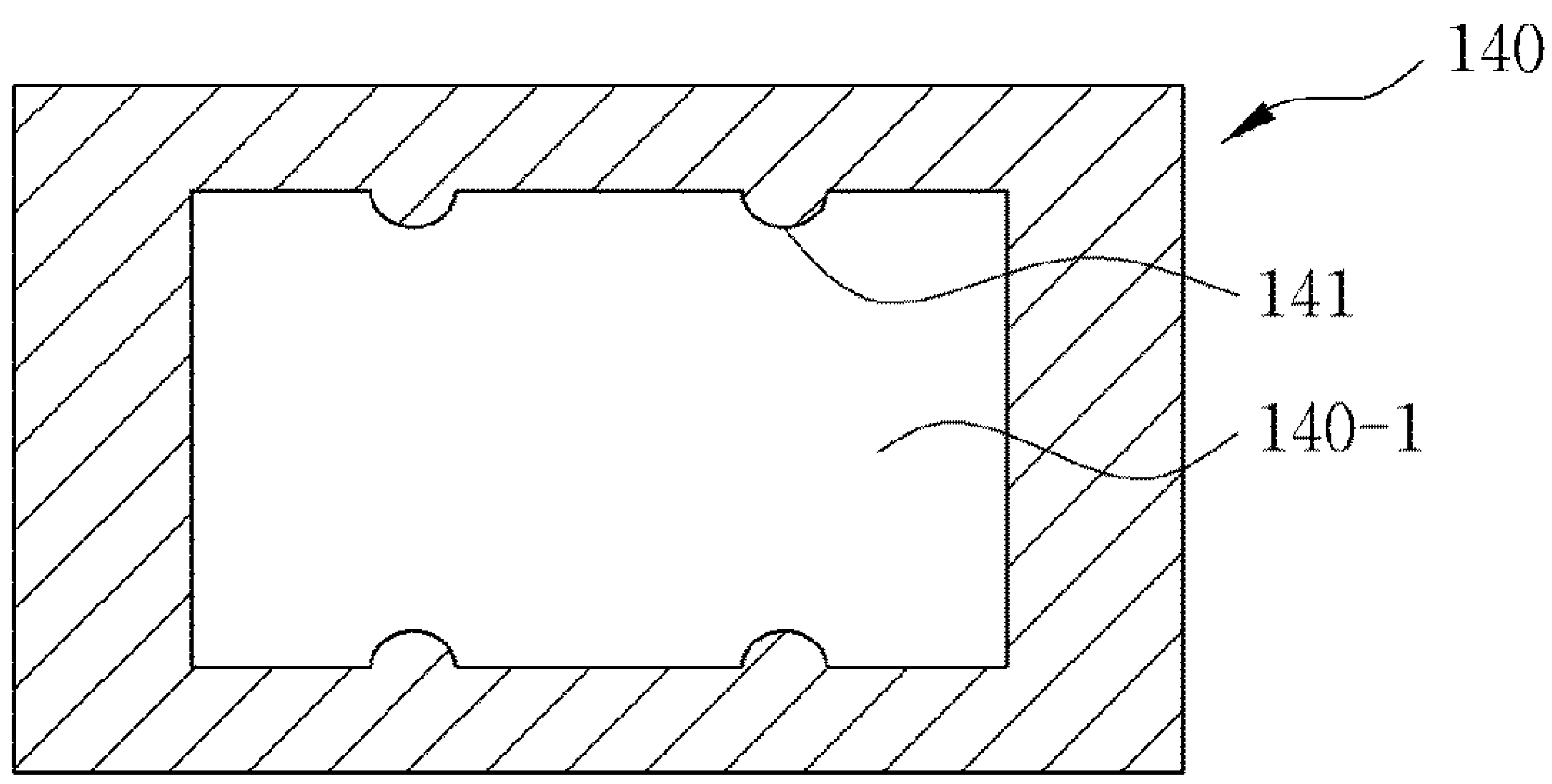

140
141
140-1

FIG.3

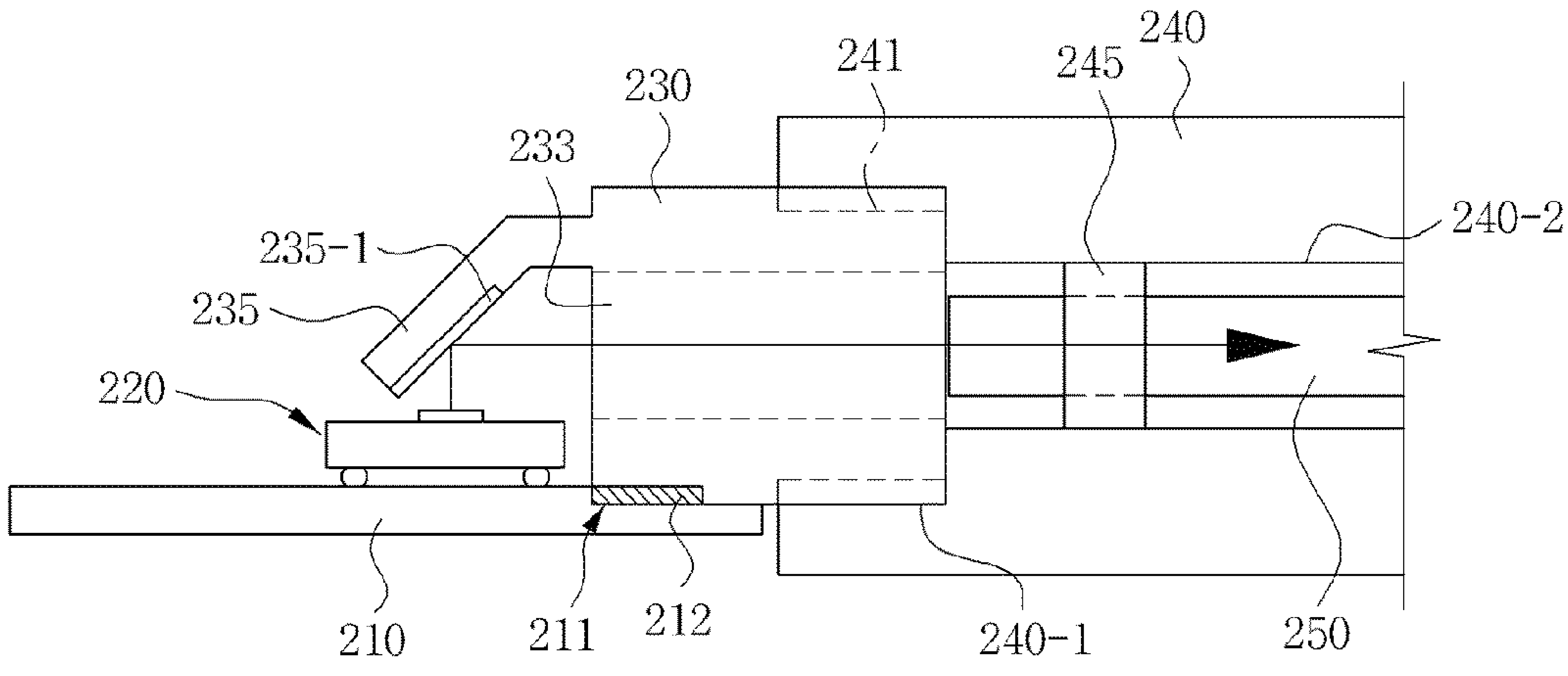
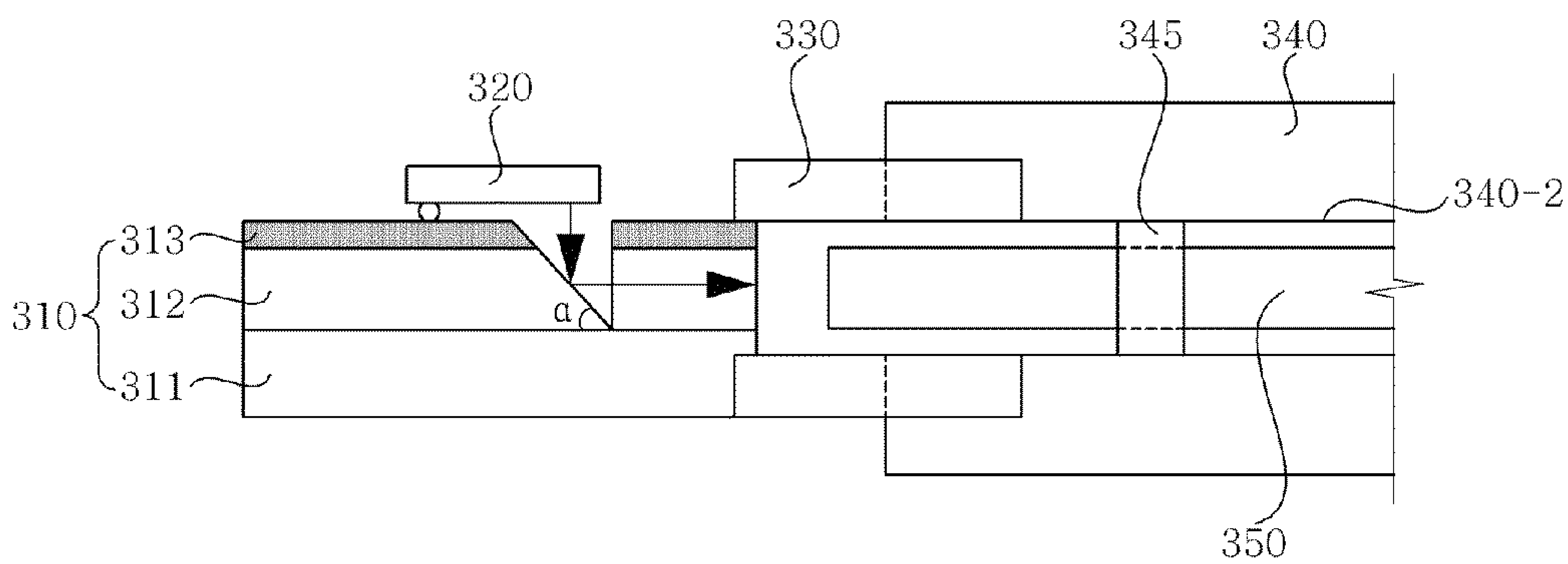
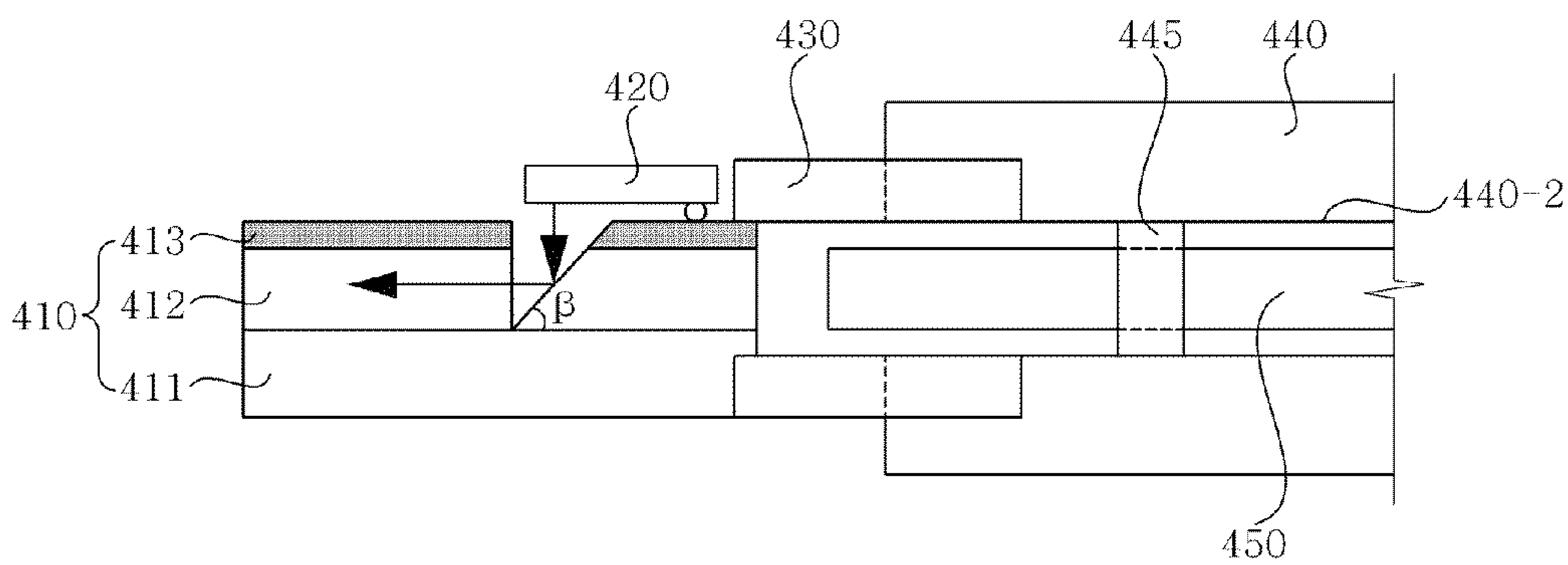

240
241
245
230
233
240-2
235-1
235
220
210
211
212
240-1
250

FIG. 4



320
330
345
340
340-2
313
312
311
310
α
350

FIG. 5



420
430
445
440
440-2
413
412
411
410
β
450

OPTICAL CONNECTOR AND OPTICAL MODULE HAVING THE SAME

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 10-2012-0069092, filed on Jun. 27, 2012, entitled "Optical Connector and Optical Module Having the Same", which is hereby incorporated by reference in its entirety into this application.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to an optical connector and an optical module having the same.

2. Description of the Related Art

Recently, an information communication environment has been developed into one wide band network in accordance with the integration of wired and wireless technologies and convergence of communication, broadcasting, and the Internet. Therefore, recently, an attempt to provide a high speed multimedia service even to a subscriber subscribing to the wide band network has accelerated. In the case of transmitting data through an existing copper line, there is a disadvantage that transmission loss is generated. Therefore, research into and development of a technology of replacing a copper line with an optical fiber has been conducted.

However, in optical communication using an optical module, the major disadvantage is that the optical module is expensive. The reason why the optical module is expensive is that an optical coupling process between an optical element and an optical fiber required for the optical module is not easy and it takes a large cost to perform optical coupling therebetween.

More specifically, in the case of the optical module according to the prior art, in order to provide stable optical coupling between the optical element and the optical fiber, a U groove or V groove is formed on a silicon optical bench (SiOB), the optical fiber is coupled thereto, and the optical element is mounted on the silicon optical bench using a flip chip bonding technology, thereby positioning the optical element and the optical fiber in a precision range required for the optical coupling between the optical element and the optical fiber.

This method may secure stable optical coupling, but requires a manufacturing process of forming the U groove or V groove on the silicon optical bench and again forming a pattern supplying an electrical signal to the optical element.

Further, in order to manufacture the optical module according to the prior art, an expensive flip chip bonding device should be used, and it takes a significant cost to manufacture the silicon optical bench, such that a cost of the optical module increases.

SUMMARY OF THE INVENTION

The present invention has been made in an effort to provide an optical module capable of allowing an optical element and an optical fiber to be optically coupled stably to each other without using a silicon optical bench.

Further, the present invention has been made in an effort to provide an optical connector for an optical module capable of allowing an optical element and an optical fiber to be optically coupled stably to each other without using a silicon optical bench.

According to a preferred embodiment of the present invention, there is provided an optical connector including: a first optical connector part including a reflecting member disposed at one side of a front end part and having a predetermined inclined angle to change a path of an optical signal of an optical element and a first through-hole through which the optical signal passes; and a second connector part including an insertion part into which the other side of the first optical connector part is inserted and a second through-hole provided with an optical fiber to which the optical signal passing through the first through-hole is incident.

The reflecting member may be a plate shaped member made of a metal material, and the inclined angle may be set to an angle for allowing the optical signal to be incident to the optical fiber.

The reflecting member may be a coated reflecting film, and the inclined angle may be set to an angle for allowing the optical signal to be incident to the optical fiber.

The reflecting film may include at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

An inner surface of the first through-hole may be provided with a coated reflecting film, wherein the coated reflecting film includes at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

The second connector part may further include a plurality of support members supporting the optical fiber provided in the second through-hole.

The support members may have a polygonal ring shape according to a cross section shape of the optical fiber and support the optical fiber at a predetermined interval along the second through-hole.

According to another preferred embodiment of the present invention, there is provided an optical module including: an optical element mounted on a substrate; and an optical connector mounted corresponding to the optical element so as to change a path of an optical signal of the optical element and transfer the optical signal having the changed path.

The optical connector may include: a first optical connector part including a reflecting member disposed at one side of a front end part and having a predetermined inclined angle to change the path of the optical signal of the optical element and a first through-hole through which the optical signal having the changed path passes; and a second connector part including an insertion part into which the other side of the first optical connector part is inserted and a second through-hole provided with an optical fiber to which the optical signal passing through the first through-hole is incident.

The optical element may include a vertical cavity surface emitting laser (VCSEL) generating and irradiating the optical signal in a direction vertical to a surface of the substrate.

The reflecting member may be a plate shaped member made of a metal material, and the inclined angle may be set to an angle for allowing the optical signal to be incident to the optical fiber.

The reflecting member may be a reflecting film including at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3), and the inclined angle may be set to an angle for allowing the optical signal to be incident to the optical fiber.

An inner surface of the first through-hole may be provided with a coated reflecting film, wherein the coated reflecting film includes at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

The second connector part may further include a plurality of support members supporting the optical fiber provided in the second through-hole.

The support members may have a polygonal ring shape according to a cross section shape of the optical fiber and support the optical fiber at a predetermined interval along the second through-hole.

According to still another preferred embodiment of the present invention, there is provided an optical module including: a substrate including a groove having an inclined surface; an optical element mounted corresponding to the groove of the substrate; and an optical connector mounted at one side of the substrate and provided with an optical fiber.

The substrate may sequentially include a base substrate, an optical waveguide, and an optical blocking film in an upward direction, and the included surface may be formed in the optical waveguide and the optical blocking film so as to have an inclined angle in a direction opposite to the optical connector.

The substrate may sequentially include a base substrate, an optical waveguide, and an optical blocking film in an upward direction, and the included surface may be formed in the optical waveguide and the optical blocking film so as to have an inclined angle in a direction toward the optical connector.

The optical element may include a VCSEL.

The inclined surface may be formed to have an inclined angle allowing an optical signal of the optical element to be reflected to another region of the substrate or the optical fiber of the optical connector.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a cross-sectional view showing a side cross section of an optical module according to a first preferred embodiment of the present invention;

FIG. **2**A is a cross-sectional view of a first optical connector part configuring an optical connection according to the first preferred embodiment of the present invention taken along the line I-I;

FIG. **2**B is a cross-sectional view of a second optical connector part configuring an optical connection according to the first preferred embodiment of the present invention taken along the line II-II;

FIG. **3** is a cross-sectional view showing a side cross section of an optical module according to a second preferred embodiment of the present invention;

FIG. **4** is a cross-sectional view showing a side cross section of an optical module according to a third preferred embodiment of the present invention; and

FIG. **5** is a cross-sectional view showing a side cross section of an optical module according to a fourth preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The objects, features and advantages of the present invention will be more clearly understood from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings. Throughout the accompanying drawings, the same reference numerals are used to designate the same or similar components, and redundant descriptions thereof are omitted. Further, in the following description, the terms "first", "second", "one side", "the other side" and the like are used to differentiate a certain component from other components, but the configuration of such components should not be construed to be limited by the terms. Further, in the description of the present invention, when it is determined that the detailed description of the related art would obscure the gist of the present invention, the description thereof will be omitted.

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the attached drawings.

FIG. **1** is a cross-sectional view showing a side cross section of an optical module according to a first preferred embodiment of the present invention; FIG. **2**A is a cross-sectional view of a first optical connector part configuring an optical connection according to the first preferred embodiment of the present invention taken along the line I-I; and FIG. **2**B is a cross-sectional view of a second optical connector part configuring an optical connection according to the first preferred embodiment of the present invention taken along the line II-II.

As shown in FIG. **1**, the optical module according to the first preferred embodiment of the present invention has a structure in which an optical element **120** is directly mounted on a substrate **110** without a silicon optical bench (SiOB) and an optical connector configured of first and second optical connector parts **130** and **140** is mounted corresponding to the optical element **120**.

The optical element **120**, which is an element converting an electrical signal into an optical signal, may be, for example, a vertical cavity surface emitting laser (VCSEL) generating and irradiating the optical signal in a direction vertical to a surface of the substrate **110**.

Therefore, in the optical module according to the first preferred embodiment of the present invention, since the VCSEL **120** is directly mounted on the substrate **110** without the silicon optical bench (SiOB), the optical module may be slimmed. Further, in the optical module according to the first preferred embodiment of the present invention, since the silicon optical bench (SiOB) is not manufactured and mounted, manufacturing and mounting costs of the optical module may be reduced.

The first optical connector part **130** includes a front end part **135** having a reflecting plate **135-1** disposed over the VCSEL **120**, corresponding to the VCSEL **120**, and is provided with a first through-hole **133** through which the optical signal of the VCSEL **120** having a path changed by the reflecting plate **135-1** passes, as shown in FIG. **2**A.

More specifically, a lower surface of the front end part **135** is provided with the reflecting plate **135-1** corresponding to the VCSEL **120** and having a predetermined inclined angle, wherein the reflecting plate **135-1** changes the path of the laser optical signal of the VCSEL **120** that is vertically irradiated toward the first through-hole **133**. The reflecting plate **135-1** may be a rectangular plate shaped member made of a metal material having high reflecting efficiency, such as gold, platinum, silver, nickel, aluminum, or the like.

The reflecting plate **135-1** is not the plate shaped member, but may also be a coated reflecting film formed on the lower surface of the front end part **135** and including a synthetic resin and a reflecting material. That is, the reflecting plate **135-1** may also be a coated reflecting film including a synthetic resin such as polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, polyvinyl chloride, or the like, and a reflecting material such as titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3), or the like.

The first through-hole **133**, which is a passage inducing the optical signal of the VCSEL **120** having the changed pass to an optical fiber **150** of the second optical connector part **140**, may be formed as a passage that may have various polygonal cross sections, in addition to a rectangular cross section shown in FIG. **2**A.

Further, an inner surface of the first through-hole **133** may be coated with a reflecting film including a synthetic resin such as polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, polyvinyl chloride, or the like, and a reflecting material such as titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3), or the like, similar to the reflecting film, which is another form of the reflecting plate **135-1**. Therefore, the optical signal of the VCSEL **120** may be induced to the optical fiber **150** without loss.

The first optical connector part **130** as described above may include an electrical connection terminal **112** disposed at one side of a lower portion thereof and electrically connected to a pad provided on an upper surface of the substrate **110** to transfer signals regarding power and speed controls for the VCSEL **120**.

In the first optical connector part **130** configured as described above, the other end of the front end part **135** is inserted into an insertion part **140-1** of the second optical connector part **140** shown in FIG. **2**B. In this case, a plurality of fastening groove lines **131** formed at an outer surface of the first optical connector part **130** are engaged with fastening protrusion lines **141** formed in the insertion part **140-1** of the second optical connector part **140**, respectively.

The second optical connector part **140** having the insertion part **140-1** in which the first optical connector part **130** is insertedly mounted as described above has a second through-hole **1402-2** extended while having a step with respect to the insertion part **140-1**.

The second through-hole **140-2** of the second optical connector part **140** as described above is provided with the optical fiber **150** supported by at least one support member **145**, as shown in FIG. **1**. Here, the support member **145** may have a polygonal ring shape such as a circular ring shape, a rectangular ring shape, or the like, according to a cross section shape of the optical fiber **150** and support the optical fiber **150** at a predetermined interval along the second through-hole **140-2**.

In this case, one surface of the optical fiber **150** mounted at the insertion part **140-1** side may have the same form and size as those of a cross section of the first through-hole **133** and be engaged with the first through-hole **133**. That is, the optical fiber **150** having the same form and size as those of the cross section of the first through-hole **133** may be engaged with the first through-hole **133** and be extended along the second through-hole **140-2** of the second optical connector part **140**.

The optical fiber **150** does not have the same form and size as those of the cross section of the first through-hole **133**, but may also contact the first through-hole **133** in a form in which it is larger than the cross section of the first through-hole **133** and be extended along the second through-hole **140-2**.

Therefore, the optical connector configured of the first and second optical connector parts **130** and **140** accomplishes stable optical coupling, such that the optical signal of the VCSEL **120** transferred through the first through-hole **133** may be easily transferred to the optical fiber **150** without the optical loss.

The optical connector in which the first and second optical connector parts **130** and **140** are optically coupled stably to each other may easily change the path of the optical signal of the VCSEL **120** toward the optical fiber **150** using the reflective plate **135-1** or the reflecting film provided at the first optical connector part **130** and having a predetermined inclined angle.

In addition, the first and second connector parts **130** and **140** are attached to or detached from each other according to various communication qualities, such that the second connector part **140** including the optical fiber **150** appropriate for the communication quality may be selected and mounted.

In addition, the optical module according to the first preferred embodiment of the present invention may provide various communication performances using the optical connector having the above-mentioned features. Particularly, the optical module according to the first preferred embodiment of the present invention does not have the silicon optical bench (SiOB) as a medium, thereby making it possible to reduce a thickness of a product.

Hereinafter, an optical module according to a second preferred embodiment of the present invention will be described with reference to FIG. **3**. FIG. **3** is a cross-sectional view showing a side cross section of an optical module according to a second preferred embodiment of the present invention. Here, in describing the optical module according to the second preferred embodiment of the present invention, components that are the same as or correspond to those of the optical module according to the first preferred embodiment of the present invention will be denoted by similar reference numerals, and a description of overlapped portions will be omitted.

As shown in FIG. **3**, the optical module according to the second preferred embodiment of the present invention is similar to the optical module according to the first preferred embodiment of the present invention except that a region of a substrate **210** at which a first optical connector part **230** is mounted is provided with a step **211**.

The above-mentioned step **211** region, which is a region including an electrical connection terminal **212** transferring signals regarding power and speed controls for a VCSEL **220** and engaged with the first optical connector part **230**, reduces a height step of the first optical connector part **230** with respect to the substrate **210**, thereby making it possible to allow stable optical coupling to be accomplished.

Therefore, the optical module according to the second preferred embodiment of the present invention may further reduce a thickness of a product while easily changing a path of an optical signal of the VCSEL **220** toward an optical fiber **250** using a reflecting plate **235-1** or a reflecting film having a predetermined inclined angle.

Hereinafter, an optical module according to a third preferred embodiment of the present invention will be described with reference to FIG. **4**. FIG. **4** is a cross-sectional view showing a side cross section of an optical module according to a third preferred embodiment of the present invention. Here, in describing the optical module according to the third preferred embodiment of the present invention, components that are the same as or correspond to those of the optical module according to the first preferred embodiment of the present invention will be denoted by similar reference numerals, and a description of overlapped portions will be omitted.

The optical module according to the third preferred embodiment of the present invention has a structure in which an optical element **320** is directly mounted on a substrate **310** without a silicon optical bench (SiOB) and includes a groove formed in the substrate **310** in order to transfer an optical signal of the optical element **320** to an optical connector configured of first and second connector parts **330** and **340**.

More specifically, the substrate **310** of the optical module according to the third preferred embodiment of the present invention may include a base substrate **311**, an optical waveguide layer **312**, and an optical blocking film **313**, wherein the optical waveguide layer **312** and the optical blocking film **313** may have a groove formed at a position corresponding to that of the optical element **320** and having an inclined angle of "α".

The above-mentioned groove has an inclined surface having the inclined angle of "α" in a direction opposite to the optical connector configured of the first and second connector parts **330** and **340** and reflects light of the optical element **320**, thereby making it possible to transfer the light to an optical fiber **350** provided in the first and second connector parts **330** and **340**.

Therefore, the inclined angle α of the groove formed in the optical waveguide layer **312** and the optical blocking film **313** may be set in the range in which the light of the optical element **320** may be reflected to the optical fiber **350**.

The optical element **320**, which is an element generating and irradiating an optical signal to the inclined surface formed at the groove of the substrate **310** and having the inclined angle α, may be a vertical cavity surface emitting laser (VCSEL).

In the optical module according to the third preferred embodiment of the present invention configured as described above, the inclined surface of the groove reflecting the light of the optical element **320** to the optical fiber **350** is directly provided in the substrate **310** without the silicon optical bench (SiOB), thereby making it possible to slim the optical module and reduce manufacturing and mounting costs of the optical module.

Hereinafter, an optical module according to a fourth preferred embodiment of the present invention will be described with reference to FIG. **5**. FIG. **5** is a cross-sectional view showing a side cross section of an optical module according to a fourth preferred embodiment of the present invention. Here, in describing the optical module according to the fourth preferred embodiment of the present invention, components that are the same as or correspond to those of the optical module according to the first preferred embodiment of the present invention will be denoted by similar reference numerals, and a description of overlapped portions will be omitted.

The optical module according to the fourth preferred embodiment of the present invention has a structure in which an optical element **420** is directly mounted on a substrate **410** without a silicon optical bench (SiOB) and includes a groove formed in the substrate **410** in order to transfer an optical signal of the optical element **420** to another region of the substrate **410**.

More specifically, the substrate **410** of the optical module according to the fourth preferred embodiment of the present invention may include a base substrate **411**, an optical waveguide layer **412**, and an optical blocking film **413**, wherein the optical waveguide layer **412** and the optical blocking film **413** may have a groove formed at a position corresponding to that of the optical element **420** and having an inclined angle of "β".

The above-mentioned groove has an inclined surface having the inclined angle of "β" in a direction toward an optical connector configured of first and second connector parts **430** and **440** and reflects light of the optical element **420** to the optical waveguide layer **412** of the substrate **410**, thereby making it possible to transfer the light to another region of the substrate **410**.

In the optical module according to the fourth preferred embodiment of the present invention configured as described above, the inclined surface of the groove reflecting the light of the optical element **420** is directly provided in the substrate **410** without the silicon optical bench (SiOB) to transfer the light to another region of the substrate **410**, thereby making it possible to slim the optical module and reduce manufacturing and mounting costs of the optical module.

With the optical connector according to the preferred embodiments of the present invention, the first and second connector parts are optically coupled stably to each other, thereby making it possible to easily change the path of the optical signal of the VCSEL toward the optical fiber using the reflective plate or the reflecting film provided at the first optical connector part and having a predetermined inclined angle.

The optical module according to the preferred embodiments of the present invention may provide various communication performances using the optical connector in which the first and second connector parts are optically coupled stably to each other. Particularly, the optical module according to the preferred embodiments of the present invention does not have the silicon optical bench (SiOB) as a medium, thereby making it possible to reduce a thickness of a product.

The optical module according to the preferred embodiments of the present invention includes the groove directly formed in the substrate and reflecting the light of the optical element, thereby making it possible to provide various communication performances. Particularly, the optical module according to the preferred embodiments of the present invention does not have the silicon optical bench (SiOB) as a medium, thereby making it possible to reduce a thickness of a product.

Although the embodiments of the present invention have been disclosed for illustrative purposes, it will be appreciated that the present invention is not limited thereto, and those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention.

Accordingly, any and all modifications, variations or equivalent arrangements should be considered to be within the scope of the invention, and the detailed scope of the invention will be disclosed by the accompanying claims.

What is claimed is:

1. An optical connector comprising:

a first optical connector part including a reflecting member disposed at one side of a front end part and having a predetermined inclined angle to change a path of an optical signal of an optical element and a first through-hole through which the optical signal passes; and

a second connector part including an insertion part into which an other side of the first optical connector part is inserted and a second through-hole provided with an optical fiber to which the optical signal passing through the first through-hole is incident,

wherein, the second connector part further includes a plurality of support members supporting the optical fiber provided in the second through-hole,

wherein the support members have a polygonal ring shape according to a cross section shape of the optical fiber and support the optical fiber at a predetermined interval along the second through-hole.

2. The optical connector as set forth in claim **1**, wherein the reflecting member is a plate shaped member made of a metal material, and

the inclined angle is set to an angle for allowing the optical signal to be incident to the optical fiber.

3. The optical connector as set forth in claim **1**, wherein the reflecting member is a coated reflecting film, and

the inclined angle is set to an angle for allowing the optical signal to be incident to the optical fiber.

4. The optical connector as set forth in claim **3**, wherein the reflecting film includes at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

5. The optical connector as set forth in claim **1**, wherein an inner surface of the first through-hole is provided with a coated reflecting film, the coated reflecting film including at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

6. An optical module comprising:

an optical element mounted on a substrate; and

an optical connector mounted corresponding to the optical element so as to change a path of an optical signal of the optical element and transfer the optical signal having the changed path,

wherein the optical connector comprises:

a first optical connector part including a reflecting member disposed at one side of a front end art and having a predetermined inclined angle to change the path of the optical signal of the optical element and a first through-hole through which the optical signal having the changed path passes; and

a second connector a including an insertion part into which an other side of the first optic connector is inserted and a second through-hole provided with an optical fiber to which the optical signal passing through the first through-hole is incident,

wherein the second connector part further includes a plurality of support members supporting the optical fiber provided in the second through-hole,

wherein the support members have a polygonal ring shape according to a cross section shape of the optical fiber and support the optical fiber at a predetermined interval along the second through-hole.

7. The optical module as set forth in claim **6**, wherein the optical element includes a vertical cavity surface emitting laser (VCSEL) generating and irradiating the optical signal in a direction vertical to a surface of the substrate.

8. The optical module as set forth in claim **6**, wherein the reflecting member is a plate shaped member made of a metal material, and

the inclined angle is set to an angle for allowing the optical signal to be incident to the optical fiber.

9. The optical module as set forth in claim **6**, wherein the reflecting member is a reflecting film including at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3), and

the inclined angle is set to an angle for allowing the optical signal to be incident to the optical fiber.

10. The optical module as set forth in claim **6**, wherein an inner surface of the first through-hole is provided with a coated reflecting film, the coated reflecting film including at least any one synthetic resin among polyethylene terephthalate (PET), polyethylene naphthalate, polymethylmethacrylate (PMMA), polycarbonate, polystyrene, polyolefin, celluloseacetate, and polyvinyl chloride and at least any one reflecting material among titanium dioxide (TiO_2), silicon dioxide (SiO_2), zinc oxide (ZnO), lead carbonate ($PbCO_3$), barium sulfate ($BaSO_4$), calcium carbonate ($CaCO_3$), and aluminum oxide (Al_2O_3).

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